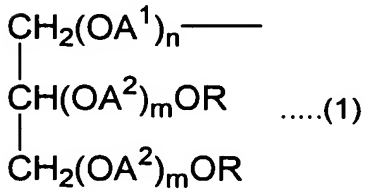
Claims

1. A modified bio-related substance, wherein at least one poly(alkylene glycol)oxy group represented by the following formula (1):



.....(1)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, and m represents 10 to 1000, is combined in a molecule.

2. The modified bio-related substance according to claim 1, wherein in the formula (1), R is a hydrocarbon group having 1 to 10 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 3 carbon atoms, n is 0 to 500, and m is 10 to 1000.

3. The modified bio-related substance according

to claim 1, wherein in the formula (1), R is a methyl group, OA^1 and OA^2 are each an oxyethylene group, n is 0 to 50, and m is 20 to 800.

4. The modified bio-related substance according to claim 1, wherein in the formula (1), n is 0.

5. The modified bio-related substance according to claim 1, wherein in the formula (1), n is 1 to 50.

6. The modified bio-related substance according to claim 1, wherein the bio-related substance has a physiological activity on a body.

7. The modified bio-related substance according to claim 1, wherein the bio-related substance is a protein or a polypeptide.

8. The modified bio-related substance according to claim 1, wherein the bio-related substance is an anticancer drug.

9. The modified bio-related substance according to claim 1, wherein the bio-related substance is an antifungal drug.

10. The modified bio-related substance according to claim 1, wherein the bio-related substance is a phospholipid.

11. The modified bio-related substance according to claim 3, wherein in the formula (1), n is 0.

12. The modified bio-related substance according to claim 3, wherein in the formula (1), n is 1 to 50.

13. The modified bio-related substance according to claim 11, wherein the bio-related substance has a physiological activity on a body.

14. The modified bio-related substance according to claim 11, wherein the bio-related substance is a protein or a polypeptide.

15. The modified bio-related substance according to claim 11, wherein the bio-related substance is an anticancer drug.

16. The modified bio-related substance according to claim 11, wherein the bio-related substance is an

antifungal drug.

17. The modified bio-related substance according to claim 11, wherein the bio-related substance is a phospholipid.

18. The modified bio-related substance according to claim 12, wherein the bio-related substance has a physiological activity on a body.

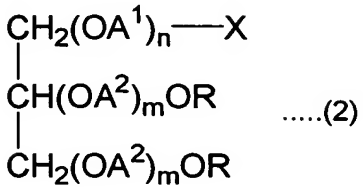
19. The modified bio-related substance according to claim 12, wherein the bio-related substance is a protein or a polypeptide.

20. The modified bio-related substance according to claim 12, wherein the bio-related substance is an anticancer drug.

21. The modified bio-related substance according to claim 12, wherein the bio-related substance is an antifungal drug.

22. The modified bio-related substance according to claim 12, wherein the bio-related substance is a phospholipid.

23. An intermediate for a modified bio-related substance, which is represented by the following formula (2):



.....(2)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, m represents 10 to 1000, and X represents a functional group capable of chemically reacting with an unmodified bio-related substance.

24. The intermediate according to claim 23, wherein in the formula (2), R is a hydrocarbon group having 1 to 10 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 3 carbon atoms, n is 0 to 500, and m is 10 to 1000.

25. The intermediate according to claim 23,

wherein in the formula (2), R is a methyl group, OA^1 and OA^2 are each an oxyethylene group, n is 0 to 50, and m is 20 to 800.

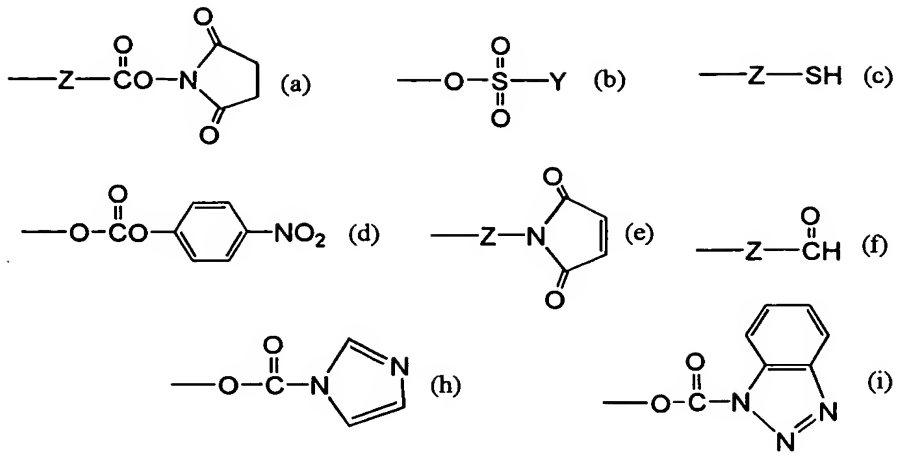
26. The intermediate according to claim 23, wherein in the formula (2), n is 0.

27. The intermediate according to claim 23, wherein in the formula (2), n is 1 to 50.

28. The intermediate according to claim 23, wherein the functional group is a functional group capable of reacting with an amino group, a mercapto group, an unsaturated bond, or a carboxyl group of the unmodified bio-related substance.

29. The intermediate according to claim 23, wherein X is a group selected from the group (I):

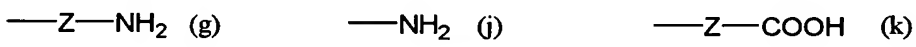
Group (I)



wherein Z represents a simple alkylene group or an alkylene group containing an ether bond, an ester bond, a urethane bond, an amide bond, a carbonate bond, or a secondary amino group and Y represents a hydrocarbon group having 1 to 10 carbon atoms which may contain fluorine atom(s).

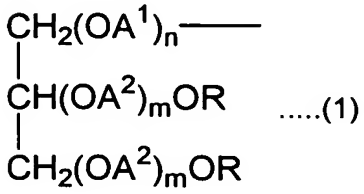
30. The intermediate according to claim 23, wherein X is a group selected from the group (II):

Group (II)



wherein Z represents a simple alkylene group or an alkylene group containing an ether bond, an ester bond, a urethane bond, an amide bond, a carbonate bond, or a secondary amino group.

31. A process for producing a modified bio-related substance wherein at least one poly(alkylene glycol)oxy group represented by the following formula (1):



.....(1)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, and m represents 10 to 1000, is combined in a molecule,

comprising a step of combining the intermediate according to claim 23 with a bio-related substance.

32. The process according to claim 31, wherein the bio-related substance has a physiological activity on a body.

33. The process according to claim 31, wherein the bio-related substance is a protein or a polypeptide.

34. The process according to claim 31, wherein the bio-related substance is an anticancer drug.

35. The process according to claim 31, wherein the bio-related substance is an antifungal drug.

36. The process according to claim 31, wherein the bio-related substance is a phospholipid.

37. The intermediate according to claim 29, wherein X is a group represented by (a) in the group (I).

38. The intermediate according to claim 29, wherein X is a group represented by (d) in the group (I).

39. The intermediate according to claim 29, wherein X is a group represented by (e) in the group (I).

40. The intermediate according to claim 29, wherein X is a group represented by (f) in the group (I).

41. The intermediate according to claim 25, wherein in the formula (2), n is 0.

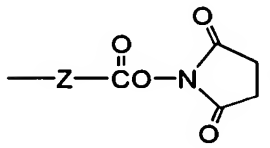
42. The intermediate according to claim 25,

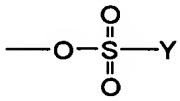
wherein in the formula (2), n is 1 to 50.

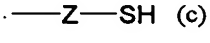
43. The intermediate according to claim 41, wherein the functional group is a functional group capable of reacting with an amino group, a mercapto group, an unsaturated bond, or a carboxyl group of the unmodified bio-related substance.

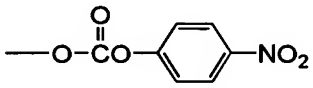
44. The intermediate according to claim 41, wherein X is a group selected from the group (I):

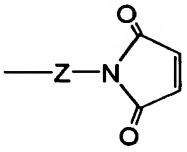
Group (I)

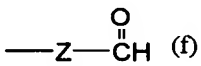

(a)

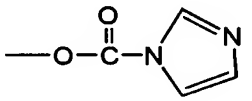

(b)

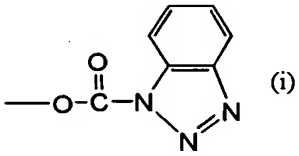

(c)


(d)


(e)


(f)

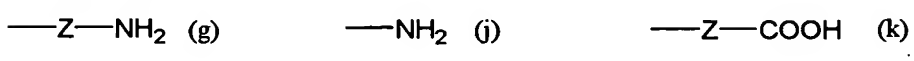

(h)


(i)

wherein Z represents a simple alkylene group or an alkylene group containing an ether bond, an ester bond, a urethane bond, an amide bond, a carbonate bond, or a secondary amino group and Y represents a hydrocarbon group having 1 to 10 carbon atoms which may contain fluorine atom(s).

45. The intermediate according to claim 41, wherein X is a group selected from the group (II):

Group (II)

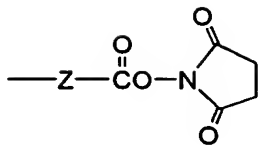


wherein Z represents a simple alkylene group or an alkylene group containing an ether bond, an ester bond, a urethane bond, an amide bond, a carbonate bond, or a secondary amino group.

46. The intermediate according to claim 42, wherein the functional group is a functional group capable of reacting with an amino group, a mercapto group, an unsaturated bond, or a carboxyl group of the unmodified bio-related substance.

47. The intermediate according to claim 42, wherein X is a group selected from the group (I):

Group (I)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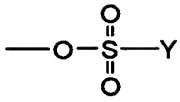
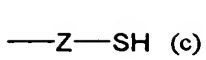
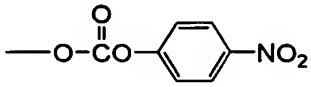
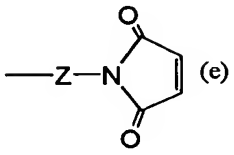
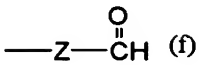
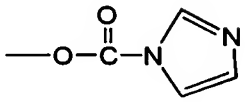
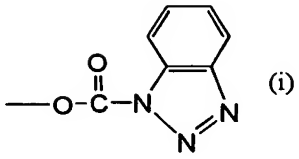
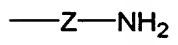
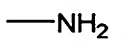

(b)

(c)

(d)

(e)

(f)

(h)

(i)

wherein Z represents a simple alkylene group or an alkylene group containing an ether bond, an ester bond, a urethane bond, an amide bond, a carbonate bond, or a secondary amino group and Y represents a hydrocarbon group having 1 to 10 carbon atoms which may contain fluorine atom(s).

48. The intermediate according to claim 42, wherein X is a group selected from the group (II):

<u>Group (II)</u>


(g)

(j)

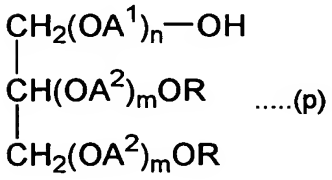
(k)

wherein Z represents a simple alkylene group or an alkylene group containing an ether bond, an ester bond, a urethane bond, an amide bond, a carbonate bond, or a secondary amino group.

49. The intermediate according to claim 44, wherein X is a group represented by (e) in the group (I).

50. The intermediate according to claim 47, wherein X is a group represented by (e) in the group (I).

51. A polyalkylene glycol derivative substantially containing no secondary hydroxyl group and being a starting material for the intermediate according to claim 23, which is represented by the following formula (p):



.....(p)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, and m represents 10 to 1000.

52. The polyalkylene glycol derivative according to claim 51, wherein in the formula (p), R is a hydrocarbon group having 1 to 10 carbon atoms, OA^1 and OA^2

are each an oxyalkylene group having 2 to 3 carbon atoms, n represents 0 to 500, and m represents 10 to 1000.

53. The polyalkylene glycol derivative according to claim 51, wherein in the formula (p), R is a methyl group, OA^1 and OA^2 are each an oxyethylene group, n represents 0 to 50, and m represents 20 to 800.

54. The polyalkylene glycol derivative according to claim 51, wherein in the formula (p), n represents 0.

55. The polyalkylene glycol derivative according to claim 51, wherein in the formula (p), n represents 1 to 50.

56. The polyalkylene glycol derivative according to claim 51, wherein polydispersity Mw/Mn in all the peaks from the starting point of elution to the end point of elution satisfies the relationship:

$$Mw/Mn \leq 1.07$$

in gel permeation chromatography of the polyalkylene glycol derivative represented by the formula (p).

57. The polyalkylene glycol derivative of the formula (p) according to claim 51, which is produced

using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

58. The polyalkylene glycol derivative of the formula (p) according to claim 56, which is produced using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

59. The polyalkylene glycol derivative according

to claim 53, wherein in the formula (p), n is 0.

60. The polyalkylene glycol derivative according to claim 53, wherein in the formula (p), n is 1 to 50.

61. The polyalkylene glycol derivative according to claim 54, which satisfies the following parameter:

$$M2/(M1+M2)\times 100 \leq 10$$

M1: an integral value of the methyl group originated from the mesyl group derived from the hydroxyl group at the 1-position directly bonded to the glycerin skeleton when a compound represented by the formula (p) is reacted with methanesulfonyl chloride to obtain a mesylated compound and a nuclear magnetic resonance spectrum thereof is measured as a deuterated methanol solution,

M2: an integral value of the methyl group originated from the mesyl group derived from the hydroxyl group of the polyalkylene glycol chain.

62. The polyalkylene glycol derivative according to claim 59, wherein polydispersity Mw/Mn in all the peaks from the starting point of elution to the end point of elution satisfies the relationship:

$$Mw/Mn \leq 1.07$$

in gel permeation chromatography of the polyalkylene

glycol derivative represented by the formula (p).

63. The polyalkylene glycol derivative of the formula (p) according to claim 59, which is produced using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

64. The polyalkylene glycol derivative of the formula (p) according to claim 62, which is produced using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end

at the 2- and 3-positions in the compound of the formula (4).

65. The polyalkylene glycol derivative according to claim 64, which satisfies the following parameter:

$$M2/(M1+M2)\times 100 \leq 10$$

M1: an integral value of the methyl group originated from the mesyl group derived from the hydroxyl group at the 1-position directly bonded to the glycerin skeleton when a compound represented by the formula (p) is reacted with methanesulfonyl chloride to obtain a mesylated compound and a nuclear magnetic resonance spectrum thereof is measured as a deuterated methanol solution,

M2: an integral value of the methyl group originated from the mesyl group derived from the hydroxyl group of the polyalkylene glycol chain.

66. The polyalkylene glycol derivative according to claim 60, wherein polydispersity Mw/Mn in all the peaks from the starting point of elution to the end point of elution satisfies the relationship:

$$Mw/Mn \leq 1.07$$

in gel permeation chromatography of the polyalkylene glycol derivative represented by the formula (p).

67. The polyalkylene glycol derivative of the formula (p) according to claim 60, which is produced using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

68. The polyalkylene glycol derivative of the formula (p) according to claim 66, which is produced using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

69. The polyalkylene glycol derivative according to claim 61, wherein polydispersity Mw/Mn in all the peaks from the starting point of elution to the end point of elution satisfies the relationship:

$$Mw/Mn \leq 1.07$$

in gel permeation chromatography of the polyalkylene glycol derivative represented by the formula (p).

70. The polyalkylene glycol derivative of the formula (p) according to claim 61, which is produced using a compound of the formula (4) as a starting material and satisfies the following parameter:

$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

71. The polyalkylene glycol derivative of the formula (p) according to claim 69, which is produced using a compound of the formula (4) as a starting

material and satisfies the following parameter:

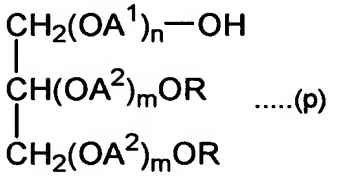
$$Hrd/Mpx1000000 \leq 3$$

Mp: a molecular weight corresponding to the peak top obtained from gel permeation chromatography of the formula (p),

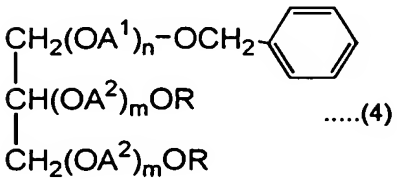
Hrd: a ratio of hydroxyl group residue contained in the alkyl group R at the polyoxyalkylene chain terminal end at the 2- and 3-positions in the compound of the formula (4).

72. A process for producing the polyalkylene glycol derivative of the formula (p) comprising the following step (A):

Step (A): a step of subjecting the compound represented by the formula (4):



.....(p)



.....(4)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, and m represents 10 to 1000, to a hydrogenative reduction reaction under a condition that a water content in a reaction system is 1% or less.

73. The process according to claim 72, wherein in the step (A), palladium is used as a hydrogenative reduction catalyst, palladium is added in an amount of 1 to 20 wt% based on the compound of the formula (4), and the reaction is carried out at a temperature of 40°C or lower.

74. The process according to claim 72, wherein as previous steps of the step (A), the following steps (B1) and (B2) are carried out:

Step (B1): a step of adding a dehalogenating agent and a compound represented by the formula (6) to a compound represented by the formula (5) and reacting them at 20 to 60°C to obtain a compound of the formula (7), provided that each charged molar ratio satisfies the following relationship:

$Vc \geq 3Va$

$Vb > Vc$

Va: number of moles of the compound represented by the formula (5)

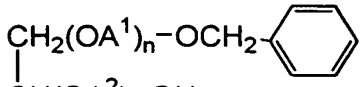
Vb: number of moles of the dehalogenating agent

Vc: number of moles of the compound represented by the formula (6);

Step (B2): a step of adding a compound represented by the formula (8) to the compound of the formula (7) and reacting them at 20 to 80°C to obtain a compound of the formula (4), provided that each charged molar ratio satisfies the following relationship:

$Vd > Vc$

Vd: number of moles of the compound represented by the formula (8);



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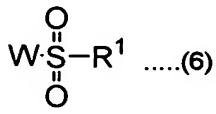

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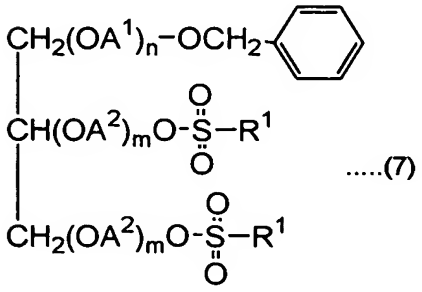


.....(7)

R—OM .....(8)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, m represents 10 to 1000, W is a halogen atom selected from Cl, Br and I, R^1 is a hydrocarbon group having 1 to 10 carbon atoms, and M is potassium or sodium.

75. The process according to claim 74, comprising a step (B3) as a successive step of the step (B2):

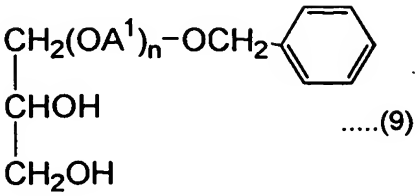
Step (B3): a step of filtrating the reaction liquid or washing the reaction liquid with an aqueous inorganic salt solution having a concentration of 10 wt% or more.

76. The process according to claim 75, wherein the steps (B1) to (B3) are repeated after the step (B3).

77. The process according to claim 75, wherein as previous steps of the steps (B1) to (B3), the following steps (C1) and (C2) are carried out:

Step (C1): a step of adding sodium or potassium in an amount of 5 to 50 mol% based on a compound represented by

the formula (9):



.....(9)

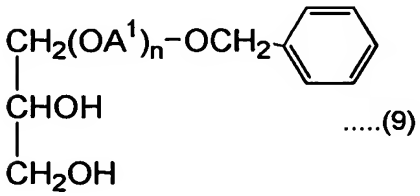
wherein OA^1 is an oxyalkylene group having 2 to 4 carbon atoms,

and dissolving the former at 10 to 50°C;

Step (C2): a step of reacting an alkylene oxide at 50 to 130°C.

78. The process according to claim 76, wherein as previous steps of the steps (B1) to (B3), the following steps (C1) and (C2) are carried out:

Step (C1): a step of adding sodium or potassium in an amount of 5 to 50 mol% based on the compound represented by the formula (9):



.....(9)

wherein OA^1 is an oxyalkylene group having 2 to 4 carbon atoms,

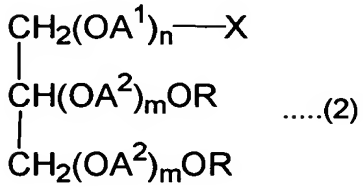
and dissolving the former at 10 to 50°C;

Step (C2): a step of reacting an alkylene oxide at 50 to

130°C.

79. A modified bio-related substance, which is obtained by the process according to claim 31.

80. A process for producing an intermediate for a modified bio-related substance, represented by the formula (2), wherein the polyalkylene glycol derivative according to claim 51 is used as a starting material:



.....(2)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, m represents 10 to 1000, and X represents a functional group capable of chemically reacting with an unmodified bio-related substance.

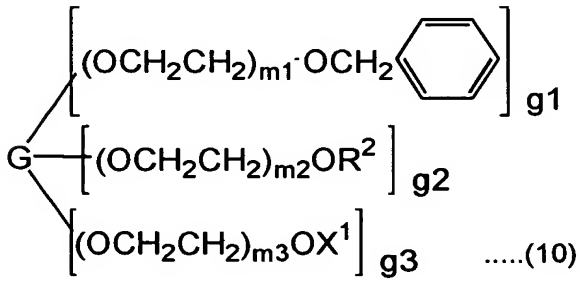
81. An intermediate for a modified bio-related substance, which is obtained by the process according to

claim 80.

82. A polyalkylene glycol derivative of the formula (p), which is obtained by the process according to claim 72.

83. A process for producing a polyalkylene glycol derivative of the formula (11), comprising the following step (AA):

Step (AA): a step of subjecting a compound represented by the formula (10) to a hydrogenative reduction reaction under a condition that a water content in a reaction system is 1% or less:



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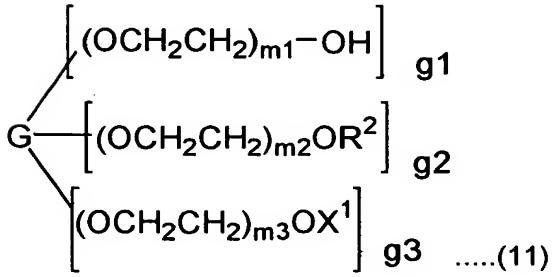


.....(11)

wherein G is a residual group of a compound having 2 to 4 hydroxyl groups; R^2 is a hydrocarbon group having 1 to 4 carbon atoms; m1, m2, and m3 represent each average number of moles of an oxyethylene group added and satisfy the following relationship:

$0 \leq m1 \leq 1000$, $0 \leq m2 \leq 1000$, $0 \leq m3 \leq 1000$, $10 \leq m1+m2+m3 \leq 1000$;

X^1 is an amino group, a carboxyl group, or a protected group thereof; and g1, g2, and g3 represent each an integer and satisfy the following relational equations:

$1 \leq g1 \leq 3$, $0 \leq g2$, $0 \leq g3$, $2 \leq g1+g2+g3 \leq 4$.

84. A process for producing a polyalkylene glycol derivative of the formula (11) according to claim 83, wherein in the step (AA), palladium is used as a hydrogenative reduction catalyst, palladium is added in an amount of 1 to 20 wt% based on the compound of the formula (10), and the reaction is carried out at a temperature of 40°C or lower.

85. A process for producing a polyalkylene glycol derivative of the formula (16), wherein the following steps (BB1) and (BB2) are carried out:

Step (BB1): a step of adding a dehalogenating agent and a compound represented by the formula (14) to a compound

represented by the formula (12) and reacting them at 20 to 60°C to obtain a compound of the formula (13), provided that each charged molar ratio satisfies the following relationship:

$Vj \geq 1.5 \times Vh \times g5$

$Vi > Vj$

Vh: number of moles of the compound represented by the formula (12)

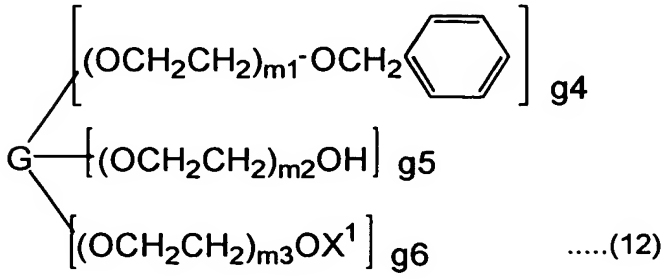
Vi: number of moles of the dehalogenating agent

Vj: number of moles of the compound represented by the formula (14);

Step (BB2): a step of adding a compound represented by the formula (15) to the compound of the formula (13) and reacting them at 20 to 80°C to obtain a compound of the formula (16), provided that each charged molar ratio satisfies the following relationship:

$Vk > Vj$

Vk: number of moles of the compound represented by the formula (15):



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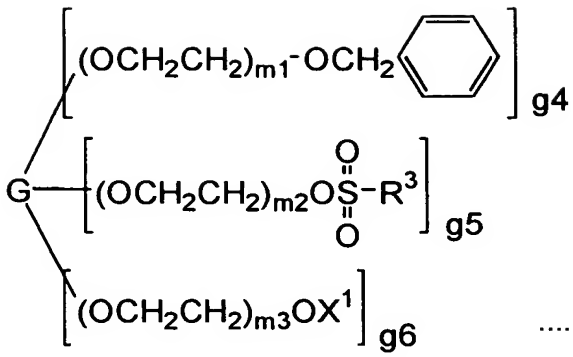
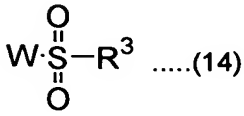
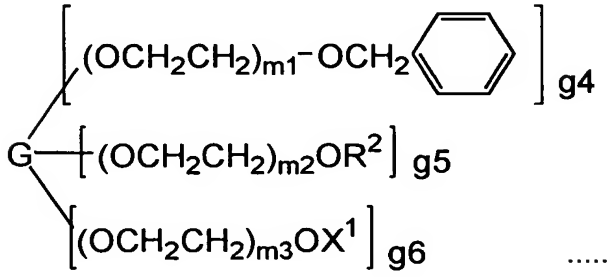


.....(13)



.....(14)

.....(15)



.....(16)

wherein G is a residual group of a compound having 2 to 4 hydroxyl groups; R^2 is a hydrocarbon group having 1 to 4 carbon atoms; m1, m2, and m3 represent each average number of moles of an oxyethylene group added and satisfy the following relationship:

$0 \leq m1 \leq 1000$, $0 \leq m2 \leq 1000$, $0 \leq m3 \leq 1000$, $10 \leq m1+m2+m3 \leq 1000$;

X^1 is an amino group, a carboxyl group, or a protected group thereof; g4, g5, and g6 represent each an integer

and satisfy the following relational equations:

$0 \leq g4$, $1 \leq g5 \leq 3$, $0 \leq g6$, $2 \leq g4+g5+g6 \leq 4$;

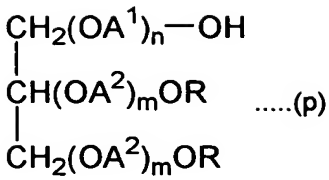
W is a halogen atom selected from Cl, Br and I; R^3 is a hydrocarbon group having 1 to 10 carbon atoms; and M is potassium or sodium.

86. The process for producing a polyalkylene glycol derivative of the formula (16) according to claim 85, comprising a step (BB3) as a successive step of the step (BB2):

Step (BB3): a step of filtrating the reaction liquid or washing the reaction liquid with an aqueous inorganic salt solution having a concentration of 10 wt% or more.

87. The process for producing a polyalkylene glycol derivative of the formula (16) according to claim 86, wherein the steps (BB1) to (BB3) are repeated after the step (B3).

88. A composition, which contains a polyalkylene glycol represented by the following formula (p) and substantially does not contain polyalkylene glycol derivative having a secondary hydroxyl group:



.....(p)

wherein R is a hydrocarbon group having 1 to 24 carbon atoms, OA^1 and OA^2 are each an oxyalkylene group having 2 to 4 carbon atoms, R and OA^2 are the same or different from each other in one molecule, n and m are each average number of moles of the oxyalkylene group added, n represents 0 to 1000, and m represents 10 to 1000.